

## **2. PLAN IMPLEMENTATION**

### **INTRODUCTION**

Implementation of this Plan involves U.S. utilities, national laboratories, universities, NRC, other industry groups, and international participants. Shrinking resources for nuclear R&D at both DOE and EPRI have forced both organizations to coordinate their research to get more done with less. Because government and industry R&D priorities may differ slightly, this Plan advocates seeking alignment in the selection and prioritization of specific R&D options, wherever possible. Therefore, it is important to define the optimum relationship of government and private industry to best meet the nation's energy needs in the most cost-effective manner. This chapter describes the roles and responsibilities for DOE and EPRI, the criteria for selecting and prioritizing R&D activities, and desirable mechanisms for coordinating R&D between the two organizations.

This Joint Strategic Plan defines nuclear energy research and development (R&D), prioritized from a combined government and industry perspective, and in the context of national needs to maintain a viable and long-term nuclear energy option. Although the current focus is on the next five to ten years, this plan will be maintained as a living document that will serve as the strategic planning document for joint nuclear energy R&D planning into the future between DOE, representing the overall national interest, and EPRI, representing the technology needs of the nation's nuclear utilities.

### **RELATIONSHIP OF THIS PLAN TO PCAST ENERGY STUDY**

The R&D priorities at DOE have been shaped significantly by the November 1997 report of the Energy Research and Development Panel of the President's Committee of Advisors on Science and Technology (PCAST). This report acknowledged the 12-fold decrease in nuclear energy R&D since 1986, proposed an increase in nuclear energy R&D investment to \$120 million in 2003, and stated that "[nuclear] fission belongs in the R&D portfolio." The PCAST Report made two key recommendations related to nuclear fission energy R&D:

"Operating Reactors: Extending the operation of nuclear plants will make it easier to meet GHG emission goals. The Panel recommends that DOE work with its laboratories and the utility industry to develop a program to address the problems that may prevent continued operation of current plants. We recommend such a program be funded at \$10M per year, to be matched by industry"

"Nuclear Energy Research Initiative: DOE should establish a new program—the Nuclear Energy Research Initiative—funded initially at \$50 million per year and increasing by FY2002 to \$100 million per year (as-spent dollars), which would competitively select among proposals by researchers from universities, national laboratories, and industry to address key issues affecting the future of fission energy, including: proliferation-resistant reactors or fuel cycles; new reactor designs with higher efficiency, lower-cost, and improved safety to compete in the global market; lower-output reactors for use in settings where large reactors are not attractive; and new techniques for on-site and surface storage and for permanent disposal of nuclear waste.

This approach is in contrast to the traditional style of directed research of the DOE Nuclear Energy Program (in which the program office defines the topics, milestones, and scope) and follows instead a model along the lines of the Environmental Management Science Program (EMSP).”

The R&D included in this Joint Strategic Plan is directed to the specific technology program needs that follow from a goal-based review of national requirements, principally those goals related to ensuring the cost-effective operation and life cycle management of currently operating nuclear plants. This R&D is market-driven and focused on near-term and medium-term technology requirements. Thus, this Joint Strategic Plan fully encompasses and addresses the first recommendation of PCAST for current plants.

In addition, this Strategic Plan relates in part to the second recommendation to establish a Nuclear Energy Research Initiative (NERI). It is possible that some requirements identified in this plan might form the basis for proposals under NERI, and that R&D conducted under NERI could form the basis for new R&D projects identified in future revisions to this plan.

Both this Joint R&D Strategic Plan and the NERI approach offer the advantages of making the R&D selection and prioritization process more open and independent, and responsive to PCAST and Congress.

### **Why Implementation via Public Private Partnership?**

The June 1995 report of the DOE’s Secretary of Energy Advisory Board (SEAB), “Energy R&D: Shaping our Nation’s Future in a Competitive World; Final Report of the Task Force on Strategic Energy R&D,” contained important advice, emphasizing the need for government collaboration with the private sector to leverage resources, obtain a clear market indication of R&D needs, and ensure more complete technology transfer of federal R&D.

Because of the many challenges to nuclear energy R&D in the 1990s, DOE and EPRI worked together to identify collaborative R&D opportunities related to existing nuclear energy plants. Electric utility executives who guide industry’s collaborative R&D program strongly supported increased funding to DOE for nuclear R&D, and increased cooperation between EPRI and DOE to minimize duplication and increase cost-sharing of common research topics.

In late 1997, DOE and EPRI agreed to create a comprehensive, integrated plan for nuclear energy R&D in support of current plants. That agreement resulted in the first edition of this “Joint DOE-EPRI Strategic Research and Development Plan To Optimize U.S. Nuclear Power Plants,” published in March 1998. This Joint Plan became the foundation for the NEPO Program.

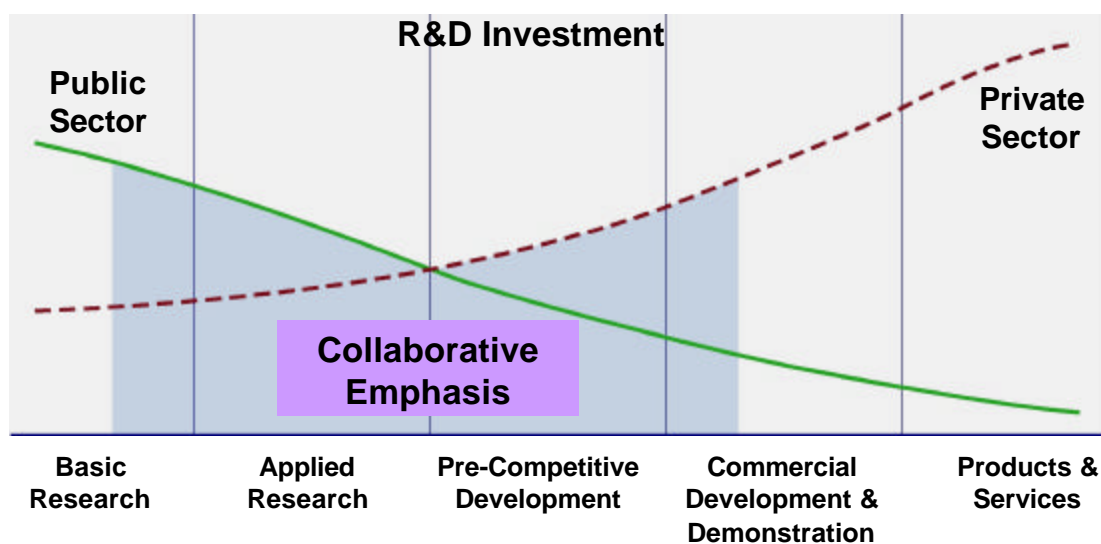
To further clarify and improve working relationships and processes, DOE and EPRI signed a Memorandum of Understanding (MOU) on Cooperation in Light Water Reactor Research Programs in October 1999. A copy is provided as Attachment D. To further improve overall working relationships and coordination, both DOE and EPRI have executed MOUs with NRC’s Office of Nuclear Regulatory Research.

## ROLES AND RESPONSIBILITIES

### Coordination Needs and Benefits

Energy industry leaders, and in particular, electric utility industry leaders, have many shared interests with the national policy makers with planning or budgetary responsibility for energy R&D. Both generally support preserving the strategic and economic advantages of a mix of energy supply options competing on an even playing field in a free market. Both are acutely aware of the need for reducing the cost and increasing the market value of R&D. Both are challenged by the taxpayers and ratepayers of the nation to ensure that energy will always be delivered safely, reliably and at low cost to all energy consumers, using fuels, supply technologies and transport methods that sustain our natural resources and environmental quality. Both are interested in leveraging the strengths of our U.S. energy technology and economic vitality to compete in world energy markets – exploiting technology leadership, where we still enjoy it, to improve balance of trade and expand high-tech domestic job opportunities. These shared interests and objectives should encourage joint planning, prioritizing, and resource leveraging (where appropriate) of R&D as it is being aggressively transitioned to the private sector for commercialization (See Figure 2-1).

## R&D: Supporting the Transition



**Figure 2-1:** Transitioning From Public to Private Sector R&D

There is a general consensus that much energy R&D, particularly short-term R&D, should be an industry responsibility, and that some energy R&D, particularly basic and/or high-risk research, should be a government responsibility. What is not well understood and determined is how to manage and fund the vast range of R&D activities that lie between basic research and short-term R&D. As a basic principle, government and industry R&D efforts should be coordinated to

avoid duplication and excessive costs and delays in bringing R&D results to commercialization. A synergistic public/private partnership can dramatically improve the cost-benefit ratio of energy R&D.

The objectives and functions of DOE and EPRI are quite similar. Both organizations strive for high performance standards, value the important contribution of nuclear energy to society, and share an interest in the efficient execution of nuclear energy R&D. Both organizations also plan R&D, obtain funding for that R&D, select contractors, and manage those contractors to complete assigned tasks on schedule and within budget. In addition, both are responsible for publishing R&D results and encouraging the application of those results to the benefit of their respective funding sources, i.e., the U.S. taxpayers who fund DOE's R&D and the U.S. utilities and their customers who fund EPRI.

The scope and funding levels for DOE's nuclear energy R&D are set by the Administration and Congress in the annual budget appropriations process. DOE contracts with universities, national laboratories, and private companies to carry out this R&D under federal contracting and procurement laws. EPRI is a nonprofit (501.C.3) institution that obtains funding from domestic and international electric utility companies and others with membership rights. It manages a collaborative R&D program in all areas of energy generation, transmission, and end-use, as well as in related science and technology areas that are of interest to the energy enterprise. EPRI also contracts under its competitive selection rules with universities, national laboratories, and private sector companies; the majority of EPRI's project work is performed by the latter.

As the resources of the two organizations have shrunk, guidance from R&D sponsors (i.e., Congress, utilities) has been for DOE to focus more on longer-term research, and for EPRI to focus more on short-term research. The percentage of DOE-sponsored R&D intended to be in used in the market place within five years is small; the corresponding percentage of EPRI-sponsored R&D in this same category is expected to be large, roughly 60 to 80 percent of the total.

Hence, the value of R&D collaboration between an industry focused more on short term goals and DOE focused more on medium and longer term goals is much more than just the benefit of leveraged funds. Since R&D can be viewed as a "pipeline" requiring sufficient investment in new ideas that lead to applied research and successful commercial product development, DOE's contribution to the partnership is invaluable to industry because DOE strengthens the front end of this process. Industry's contribution to the partnership comes from providing to DOE more direct and valuable insights into the real market needs and opportunities, thus increasing the percentage of DOE's medium and longer term research investment that will ultimately reach the marketplace. By coordinating their efforts, DOE and EPRI more effectively manage this transition between long-term and short-term R&D, thereby delivering the greatest possible value to R&D sponsors and the nation at large.

Working with EPRI provides DOE with a single, direct interface with utilities for all nuclear energy R&D, to obtain market input and provide pilot application of DOE-developed technologies. EPRI will fill DOE's need to show value to its long-term research efforts through the product development phase and enable private sector commercialization, while DOE will fill

EPRI's need for basic, long-range research to support its more applications-oriented, near- and mid-term R&D. DOE also will act as a catalyst for industry to develop needed technologies that have economic value and are beneficial to the Nation, but are considered high-risk for sole industry investment.

### **Priorities and Responsibilities**

Under this Plan, R&D priorities should reflect (1) major national criteria such as economic strength, energy security, environmental quality, and science and technology leadership, and (2) major industrial and consumer requirements such as safety, reliability, economic competitiveness, stable fuel supply, and efficient regulation. These R&D priorities should be set in a collaborative process where industry and government work together to define needs and priorities and allocate R&D funding in accord with the following responsibilities. In this context, short-term refers to 0 to 5 years, mid-term refers to 5 to 10 years, and long-term represents 10 to 50 years.

*Sole industry responsibility:* Short-term, low-risk development to the point of commercial readiness, or R&D needed by industry that does not include a compelling public or national interest involved.

*Sole government responsibility:* R&D requirements where there is a vital national interest involved, but no direct commercial interest or benefit to industry. Examples include nonproliferation technologies and very long-term or basic research with no clear horizon for commercial application, such as nuclear fusion. There are no R&D requirements of this type included in this Plan.

*Joint government/industry responsibility:* Requirements for near- to mid-term R&D that support common interests, but represent high economic risk to the industry for sole industry funding.

This last category contains the largest and most strategically important segment of R&D; because of these dual responsibilities, it is the one that requires the greatest planning effort for success.

### **Relationship to Nuclear Research Performed by the Nuclear Regulatory Commission**

NRC's role (specifically, the role of the NRC's Office of Nuclear Regulatory Research) is very different from the roles of DOE and industry. Most importantly, NRC does not develop new technology to address issues at nuclear power plants. In fact, much of NRC's research program is focused on conducting confirmatory testing and analysis on technologies used by commercial nuclear power plants. NRC's role is to assure that it can provide the regulatory offices within NRC, and the public at-large, with independent assurance that the technologies developed by DOE and/or industry for use in nuclear power plants are safe. NRC must also conduct confirmatory research as part of its responsibility to develop regulations for use of new technology in nuclear power plants.

There are many instances in which DOE and/or industry conducts research, for which there is no corresponding research activity at NRC; e.g., developing new technologies for nuclear plants which do not require regulatory approval. Sometimes NRC conducts research in an area for which no corresponding research activity exists at DOE or in industry. An example is research on a regulatory issue for which industry believes no safety concern exists, but for which NRC has an obligation to confirm that issue does not present a significant risk to the public. Finally, there are instances where, of necessity, DOE, industry, and NRC all need to conduct research because it is within their respective missions, or legal responsibilities, to obtain answers to a technical issue. In such cases, NRC is obligated to arrive at its safety conclusions independently. That does not mean that NRC cannot share the cost of an expensive test program or data collection effort with DOE, industry, or both, to help answer a technical issue, as long as the cooperation is restricted to the scientific, data collection phase of the research. When a research effort reaches a point where data have been collected and interpretation of that data is ready to start with regard to what that data show about adequacy of safety or the potential need for additional regulation, NRC must do its work independently.

Regarding the proposed R&D activities in this Strategic Plan, there are instances in which NRC already has ongoing programs, or might have R&D programs in the future. NRC's programs will always be focused on providing the technical basis for regulatory decisions, in contrast to the focus of DOE's and industry's programs, which is on development of new technology, methods, and equipment that could be used to achieve the Goals of this Plan. In the area of license renewal, DOE's role is in support of the utilities as applicants to NRC, much as was DOE's role during the ALWR program as a supporter of reactor designers applying for design approval and design certification.

DOE, industry, and NRC closely coordinate their planning to assure that the respective programs are complementary and cost-effective. Both DOE and EPRI have Memoranda of Understanding (MOU) with NRC governing cooperation and avoidance of duplication. In an increasingly significant number of cases, research is jointly funded to conserve taxpayer or ratepayer funds.

## **PROJECT SELECTION, PRIORITIZATION, AND COORDINATION**

### **Implementing the Joint Strategic Plan: 1998 to Date**

A committee was established in August 1998 by DOE and EPRI to coordinate government/industry R&D planning. The committee was designated as the "Coordinating Committee for the Joint DOE-EPRI Strategic R&D Plan To Optimize U.S. Nuclear Power Plants," or the "Joint Coordinating Committee". This committee is comprised of 12 utility executives and senior managers, and a representative from the NRC, the Nuclear Energy Institute (NEI), the Institute of Nuclear Plant Operators (INPO), DOE's national laboratories, and the university community. The chairman of the Joint Coordinating Committee is the chairman of EPRI's Nuclear Power Council (NPC). The utility members of the committee comprise the chairmen of the various committees and subcommittees of the NPC (as well as NPC members-at-large) with responsibility over R&D within the NEPO program scope.

The Joint Coordinating Committee ensures that jointly funded R&D, particularly projects funded by NEPO, address the highest priority issues and unmet needs of current nuclear plants. The Joint Coordinating Committee also ensures coordination of nuclear R&D within this scope among all participating organizations, and ensures consistency with PCAST, Federal Government initiatives, and industry guidance. This committee also oversees revisions to this Joint Strategic Plan. The Joint Coordinating Committee Charter is provided as Attachment E.

In October 1998, NERAC was chartered by DOE to advise the agency on nuclear R&D issues. One of the four subcommittees under NERAC is the Subcommittee on Operating Nuclear Power Plant Research, Coordination, and Planning, with responsibility to advise DOE on the conduct of R&D, including criteria for prioritizing research for operating nuclear power plants, with a focus on NEPO. The Subcommittee has acknowledged the role of the Joint Coordinating Committee in providing detailed recommendations on cost-shared R&D within the scope of the Joint Strategic Plan, and has offered suggestions to the Joint Coordinating Committee on both its charter and the content of the R&D program that it coordinates. At the request of the NERAC Subcommittee, the Chairman of the Joint Coordinating Committee serves on the NERAC Subcommittee, for continuity.

The final selection of projects for funding under NEPO is made by the Director, DOE Office of Nuclear Energy, Science, and Technology; and by EPRI's Vice President Nuclear and Chief Nuclear Officer.

With funding for NEPO approved for FY2000, the first full meeting of the Joint Coordinating Committee was held on 29 Sept. 1999, concurrent with the fall meetings of the EPRI NP advisory structure and NP Council. (Earlier meetings of initial members of the Coordinating Committee were held in Aug. 1998 and Jan. 1999 to explain the concept for cooperation, seek input, draft an initial charter, etc.) At its September 1999 meeting, the Committee approved its charter, elected its Chairman and Vice Chairman, and identified a total of fifteen projects that it recommended for joint funding for FY2000. These recommendations were made from an updated Joint Strategic Plan (Volume II), consisting of high priority tasks from the 1998 Joint R&D Plan, plus new tasks identified in 1999.

This prioritization and selection of the work to be performed under NEPO under FY2000 funding was reviewed and endorsed by the NERAC Subcommittee on Operating Nuclear Plant R&D, with comment that greater emphasis be placed on human performance, licensing criteria for digital up-grades, and generic resolution of licensing technical issues in FY01 and in so far as practicable in FY00. The full NERAC endorsed the proposed NEPO program content and the Subcommittee's recommendations in Dec. 1999. DOE and EPRI began the process of establishing a Cooperative Agreement to facilitate joint management and joint funding of projects. This task was completed in 2000, and work on all projects selected for FY00 funding was initiated.

In mid 2000, this process was repeated for FY2001 funding, with a number of enhancements that will be further refined to accommodate the annual planning and funding cycles of both DOE and EPRI. A Workshop was held in July 2000 to solicit inputs for FY2001 funded projects. Workshop participants included representatives from nuclear utilities, national laboratories,

universities, supported by DOE and EPRI staff. These inputs were presented to the Joint Coordinating Committee in August 2000 for their review and recommendations to DOE and EPRI for funding. Input was again received from the NERAC subcommittee as well. The Coordinating Committee recommended funding nine new projects and nine projects from FY00 that were proposed initially for multi-year funding and that were still considered sufficiently high priority for continued funding.

Based on this overview of actual implementation during the formative years of 1999 and 2000, the remainder of this Section will review the implementation process from a generic, ongoing perspective.

### **Selection and Prioritization**

The R&D areas for this Plan are identified based on information received by both DOE and EPRI from utilities, utility organizations, national laboratories, NRC, and other stakeholders. Initial prioritization of work identified in Chapters 3 through 5 is done by DOE and EPRI staff, based on national and marketplace needs. The priority tasks are organized along project lines, and detailed project descriptions are developed and included in Volume II. It should be noted that at the point projects are included in Volume II, they are DOE and EPRI staff recommendations only. They are subject to review and recommendation by the Joint Coordinating Committee, endorsement by the full Nuclear Power Council of EPRI, NERAC review and endorsement, and final approval by DOE and EPRI. This process takes into consideration what research is being supported by other public agencies and private organizations, such as the Nuclear Regulatory Commission. Selected activities are closely coordinated by DOE and EPRI with utilities and with R&D contractors (universities, national laboratories and commercial contractors).

The R&D selected for funding by DOE should have generic applicability to the industry, should represent high economic risk or benefit to the industry, and should have the potential for high payoff in national energy security goals in the mid- to long term. Ultimately, the prioritization and selection recommendations by the Joint Coordinating Committee are based on answers to the following questions:

- Does the activity help maintain or increase the operating lives of existing plants?
- Does it reduce regulatory or economic uncertainty?
- Is it applicable to multiple plants?
- Is it mid- to long-term R&D of high economic risk to the industry?
- When is it needed and what is the likelihood of success?
- Can DOE, including national laboratories, provide unique, value-added contributions to execute the activity?



- What is the cost to DOE?

The review and approval process on the EPRI side starts with review by the cognizant utility advisory committee or subcommittee responsible for each technology area and recommendations from that subcommittee to the Joint Coordinating Committee. Recommendations for funding from the Joint Coordinating Committee are subject to review and concurrence by the Nuclear Power Council, representing all the nuclear utility members of EPRI. This utility review and concurrence will ensure market relevance of all proposed projects and assist in adjustment of priorities to obtain the greatest value from the proposed R&D.

Even though the Nuclear Power Council has asked EPRI to focus its R&D more toward short-term products, this group of utility executives is the best executive-level industry group available to advise on medium and long-term nuclear R&D. This Council advises EPRI on its modest long term R&D programs, has engaged in strategic planning and gap analysis of R&D plans, and understands which long-term efforts are most likely to preserve and advance nuclear technology in the right directions and produce the best value to the Nation. Hence, EPRI senior advisors will support a utility review of the projects proposed under this joint R&D plan, as well as recently completed work under this plan, to ensure proper selection, adequate oversight, proper prioritization, and adequate progress against R&D performance measures.

DOE uses the Nuclear Energy Research Advisory Committee and its Subcommittee on Operating Plants to provide additional insight and perspective on R&D related to current plants and to ensure the R&D selected is consistent with national policy objectives.

The funding for different projects may involve participants other than DOE and EPRI. Also, not all activities identified in this Joint Strategic Plan will be co-funded by both EPRI and DOE. In many cases, DOE and EPRI will jointly plan and coordinate the various tasks within an overall project, and then separately fund those individual tasks. This model for cooperative research is often easier to implement and still allows all the advantages of overall cooperation on projects that require coordination. In general, the DOE uses standard government procurement practices for all directed, competitively bid work scopes. For activities that are jointly funded, a cooperative agreement between EPRI and DOE was established to permit contractor funding under EPRI contracting procedures. Specific technical projects are awarded on a competitive basis, unless there is some unique capability that justifies the work being performed at a specific location or by a specific contractor.

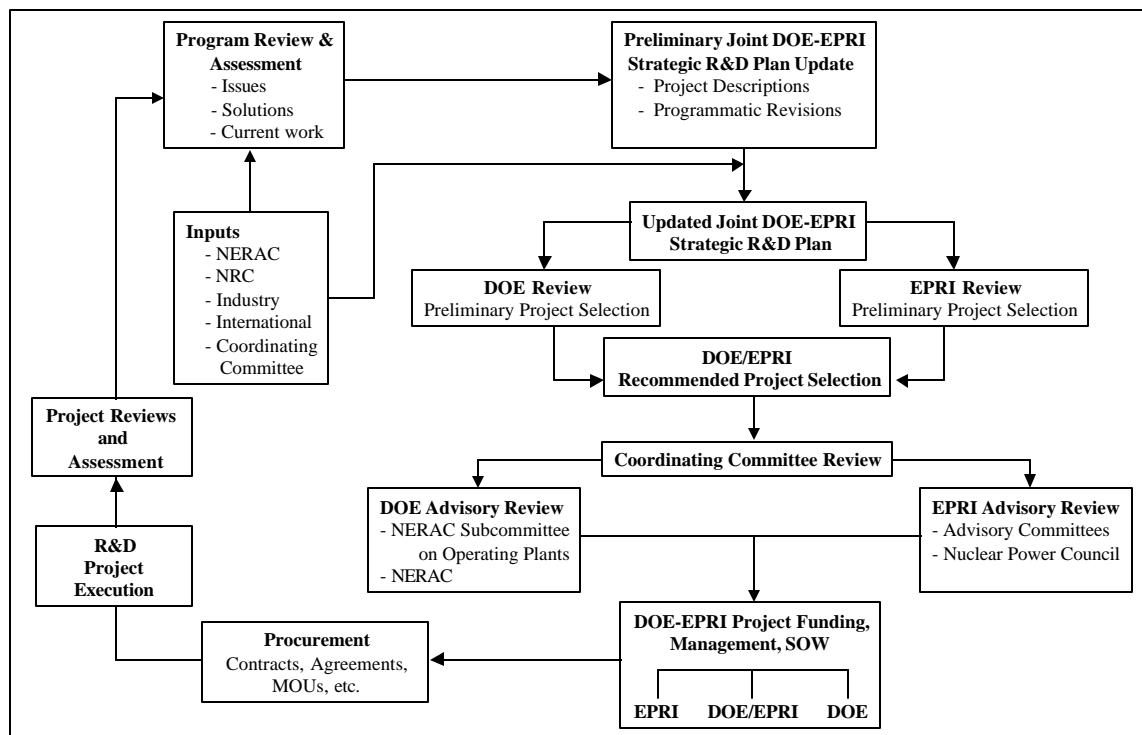
### **Mechanisms for Coordinating Research**

EPRI and DOE jointly established a Sustainable Electricity Partnership (SEP) in 1994, chartered by Secretary O'Leary and EPRI President Balzhiser, to increase their coordination and joint sponsorship of energy R&D. The key elements of this initiative are an annual coordinating conference and a set of standardized, high-level financial agreements (a model cooperative agreement and a model participation agreement) that allow EPRI and DOE to jointly fund work or transfer funds from one organization to the other to help fund the work of the other organization. These agreements come under government rules for cooperative agreements with

nonprofit organizations, not under standard government contract rules. This gives both organizations greater flexibility to cost-share work for mutual benefit.

In October 1999, DOE and EPRI established a Memorandum of Understanding (MOU) on Cooperation in Light Water Reactor Research Programs. The purpose of that MOU was to establish the guiding principles under which cooperative research programs between EPRI and DOE's Office of Nuclear Energy, Science, and Technology will be planned and conducted. That MOU established the foundation, along with standard DOE procedures, for a Cooperative Agreement to govern the jointly managed NEPO program. This Cooperative Agreement was developed in early 2000 and signed in May 2000. It provides the funding and joint management mechanisms and protocols for NEPO, under the authority of a Management Team consisting of the DOE Project Officer and the EPRI Project Director.

The overall process for annual planning, execution, and assessment is shown in Figure 2-2. All



**Figure 2-2: Project Selection and Implementation**

of these mechanisms involve direct utility participation in the actions and decisions by EPRI, since the nuclear utilities oversee EPRI's work and have a high interest in the success of all joint efforts with DOE.

Finally, all research projects must be coordinated with NRC at the planning and selection stage. For many proposed R&D projects described in this document, there is no corresponding NRC research; however, independent evaluations, confirmatory research, or testing may be required prior to in-plant demonstration of DOE and industry developed technologies. And, as discussed under Roles and Responsibilities, NRC may also fund joint research or use data collected from

DOE and EPRI research for their regulatory function. DOE and NRC must closely coordinate their planning to ensure that the two government programs are complementary, not duplicative. DOE, EPRI, and industry will coordinate their efforts under this Strategic Plan with NRC's actions to minimize duplication of effort and maximize R&D output in a cost-effective manner. Also note that the Director of NRC Research serves on the Joint Coordinating Committee.

### **Performance Measures**

Tasks will be selected based on the criteria outlined above. The planning of each selected project requires the establishment of specific, quantifiable (where appropriate) performance measures/milestones before the work begins so that the success of the project can be measured and tracked. Verification that performance measures are met is the responsibility of the Management Team. Further, the Joint Coordinating Committee and NERAC review projects against milestones and other measures.

### **Overall Funding Requirements**

Commercial nuclear energy R&D has been a very small percentage of DOE's overall energy R&D budget in recent history, and has been on a steady decline starting in 1992. It dropped from \$125 million in 1992 to \$38 million in fiscal year 1997 and was eliminated entirely in fiscal year 1998. At \$38 million in fiscal years 1996 and 1997, this level of R&D investment represented less than two percent of DOE's energy R&D spending, and less than a quarter of one percent of the total DOE budget. EPRI's total annual spending on nuclear energy R&D has ranged between \$70 million and \$115 million over the past decade, reaching a peak of \$115 million in 1995 (the year of highest utility spending on the ALWR Program), and declining to about \$90 million in 1998-2000. On average, roughly 25 percent of EPRI's overall utility-controlled budget (which has been essentially market-driven in recent years) has gone to nuclear energy R&D; however, overall utility investment in all energy R&D, including nuclear, has gone down about 25 percent in the past five years. This is primarily due to the pressures of deregulation and increasing retail competition.

PCAST recommended that DOE work with its laboratories and the utility industry to develop a program to address the problems that may prevent continued operation of current plants. The recommended funding level of this program is \$10 million per year, to be matched by industry. The total DOE funding levels recommended by PCAST for fission energy, including NEPO, NERI and university programs were \$66 million for FY 1999, increasing to \$119 million in FY 2003.

Actual funding for NEPO in both FY00 and FY01 was only \$5 million. In each year, EPRI provided well in excess of the matching cost share required by Congress. Each year, DOE and EPRI staff presented about \$18 million to \$20 million in total annual funding requirements to the Joint Coordinating Committee, from which they recommended selection of about \$11-13 million in total annual work (DOE funding at \$5 million and EPRI funding at \$6-8 million). Many of these projects have multi-year funding requirements, so at any point in time, approved NEPO projects typically require \$30-\$50 million to complete over 2-5 years.

The project selection process is highly competitive and focuses exclusively on the project's need and value to current plants and to national goals. Contractors are selected *after* a project is approved for funding, which provides additional objectivity and integrity to the selection process.

The experience gained to date in managing the Joint Strategic Plan and the NEPO program suggests that sufficiently high priority needs exist to accommodate funding levels 2-4 times greater than provided by appropriations in FY00 and FY01. It is industry's intent to propose DOE funding for NEPO in FY02 at \$10M, consistent with the PCAST recommendation. Industry is prepared to provide cost share at this higher funding level.

Each project identified in Volume II includes an estimated funding requirement. It should be noted that, although identification and description of the critical R&D needs is fairly complete in this Plan, the projects included in Volume II are expected to evolve during implementation. The degree of definition for each project included in Volume II varies in accordance with the current state of development for the proposed technology. Obviously, in cases where the feasibility is demonstrated, technology development could proceed until it actually can be used, and the associated funding requirements would increase. On the other hand, in cases where more than one potential solution is being investigated, only the most promising solutions would proceed through the phases of prototype demonstration and commercialization. It should be further noted that the duration of project completion provided in the project descriptions is only for the work identified and does not represent the time period required to make a particular technology available for deployment.

### **Schedule**

The schedule for all proposed NEPO projects is provided in Volume II.